Wilmington District

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20 1775
ESSE QUAM VIDERI

Wilmington Harbor General Reevaluation Report

Alternative Formulation Briefing

October 4, 2007

Wilmington District

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20 1775
ESSE QUAM VIDERI

General Reevaluation Report (GRR)

- GRR used for reanalysis of a previously completed study where construction is not complete – Wilmington Harbor 96 Act Deepening project
- Uses current planning criteria and policies
- Changed conditions and/or assumptions.
  - Need for relocated turning basin and changes to mitigation plan fo
- Follow six step planning proce
- Environmental Operating Princ
- Multidisciplinary approach (PD

Wilmington District

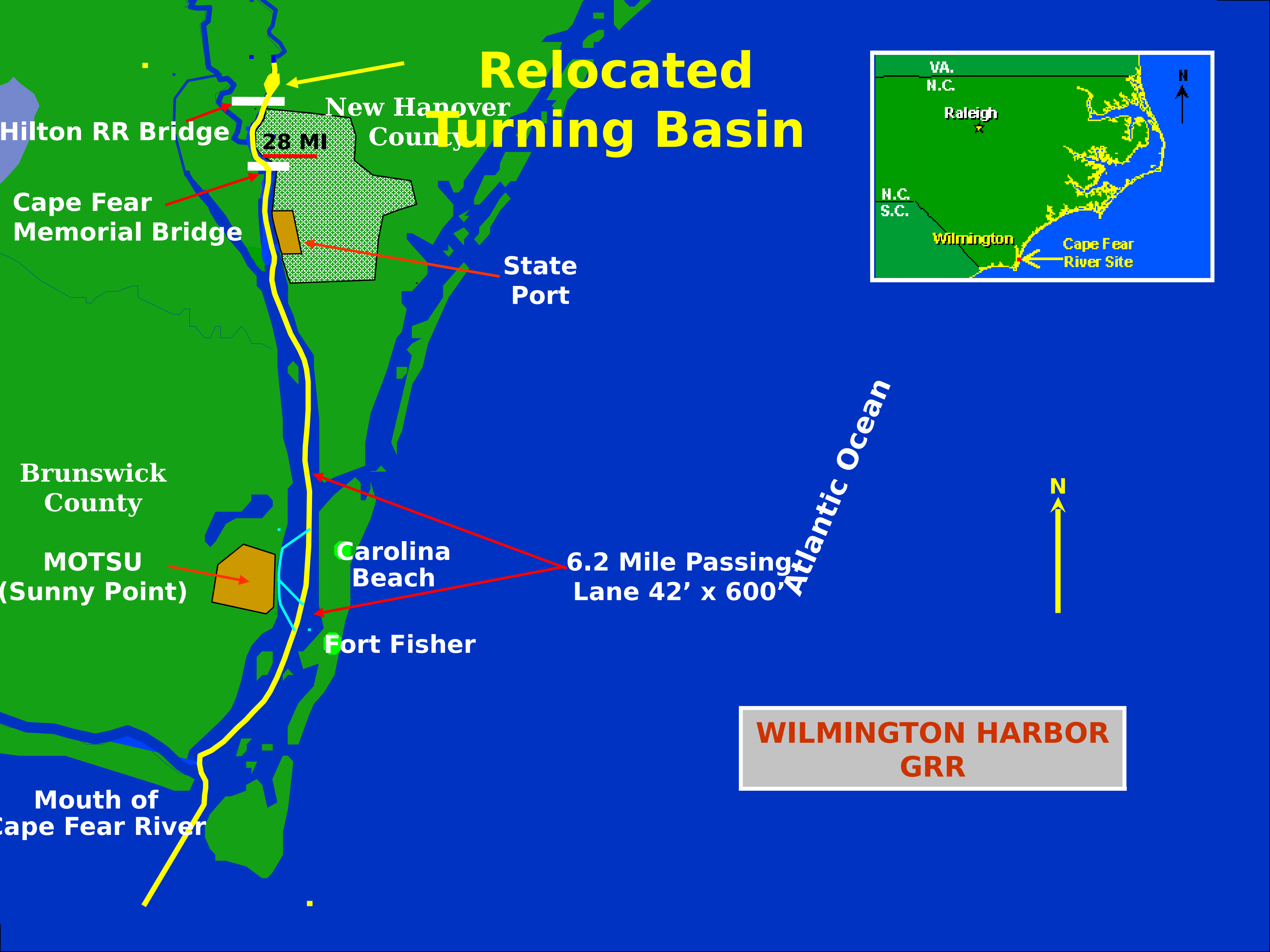
General Reevaluation Report (GRR)

Wilmington Harbor GRR

Components

- Relocation of a ship turning basin in the NE Cape Fear River
- Fish passage at the Cape Fear River Locks and Dams

Relocated Turning Basin


Hilton RR Bridge
28 MI
New Hanover County
Cape Fear Memorial Bridge
State Port
Brunswick County
MOTSU (Sunny Point)
Carolina Beach
Fort Fisher
6.2 Mile Passing Lane 42’ x 600’
Atlantic Ocean
N
Mouth of Cape Fear River
VA.
N.C.
Raleigh
N.C.
S.C.
Wilmington
Cape Fear River Site
N

WILMINGTON HARBOR GRR

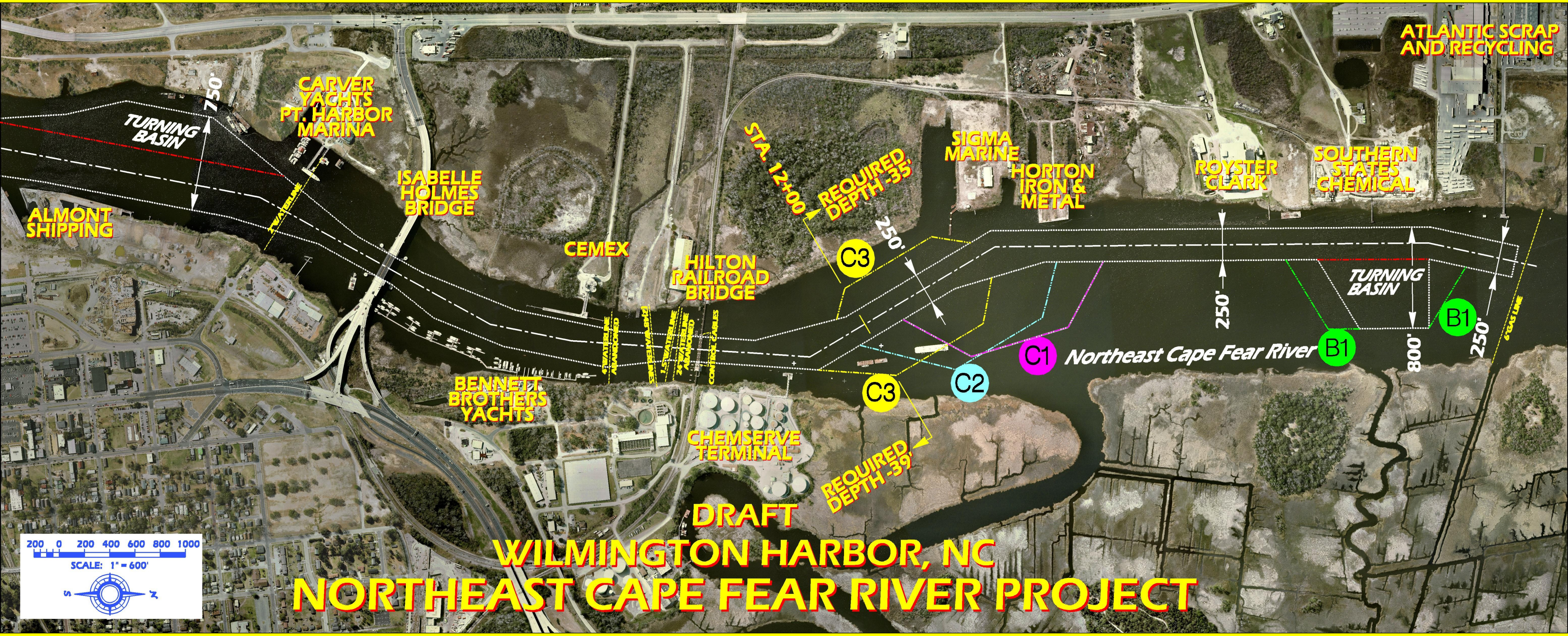
Wilmington District

Relocated Turning Basin

- Tight squeeze during daylight going bow first
- At night, backing stern first even more difficult

Wilmington District

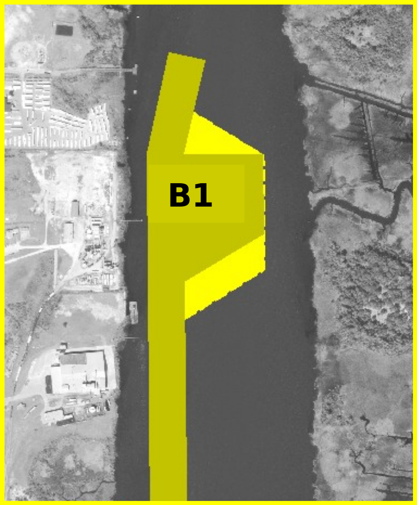
Potential Relocated Turning Basin


ATLANTIC SCRAP AND RECYCLING
CARVER YACHTS PT. HARBOR MARINA
TURNING BASIN
750'
ALMONT SHIPPING
1" WATERLINE
ISABELLE HOLMES BRIDGE
CEMEX
4" WATERLINE ABANDONED
(2) 8" WATERLINES
1.5" WATERLINE
24" WATERLINE ABANDONED
CONTROL CABLES
HILTON RAILROAD BRIDGE
STA. 12+00
REQUIRED DEPTH -35'
250'
C3
SIGMA MARINE
HORTON IRON & METAL
ROYSTER CLARK
SOUTHERN STATES CHEMICAL
TURNING BASIN
250'
800'
250'
6" GAS LINE
B1
B1
C1
C2
C3
Northeast Cape Fear River
BENNETT BROTHERS YACHTS
CHEMSERVE TERMINAL
REQUIRED DEPTH -39'
DRAFT
WILMINGTON HARBOR, NC
NORTHEAST CAPE FEAR RIVER PROJECT
200 0 200 400 600 800 1000
SCALE: 1" = 600'
S
N

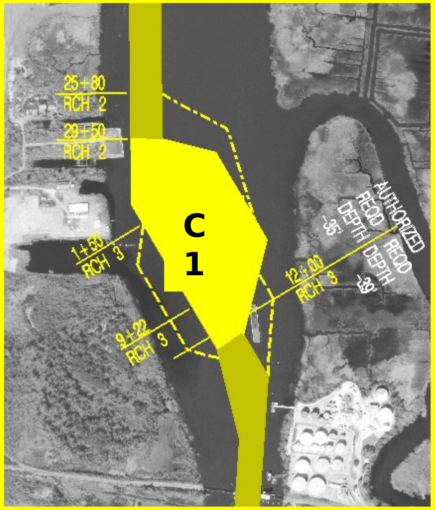
Wilmington District

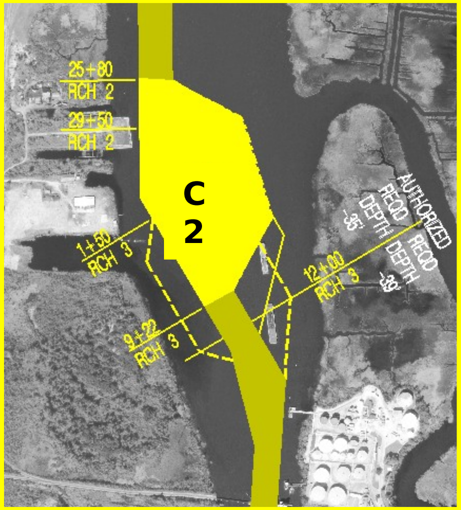
Turning Basin Alternatives - Summary of Quantities

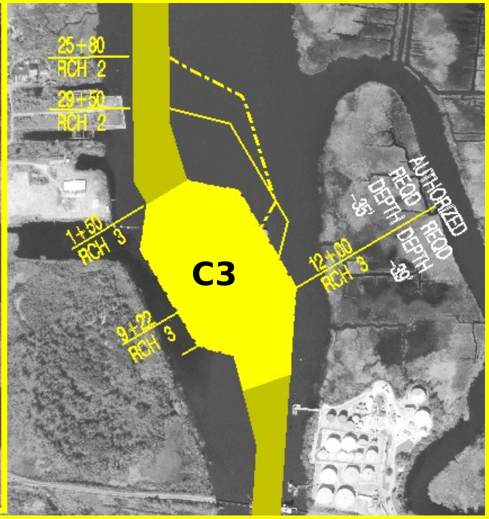
THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20 1775



ALT B1 - Sediment: 604K CY | Rock: 303K CY | PNA:8.8 AC


25+80
RCH 2
29+50
RCH 2
C
1
1+50
RCH 3
9+22
RCH 3
12+00
RCH 3
AUTHORIZED DEPTH
RECD DEPTH
RECD DEPTH
-35'
-38'


25+80
RCH 2
29+50
RCH 2
C
2
1+50
RCH 3
9+22
RCH 3
12+00
RCH 3
AUTHORIZED DEPTH
RECD DEPTH
RECD DEPTH
-35'
-38'


25+80
RCH 2
29+50
RCH 2
C3
1+50
RCH 3
9+22
RCH 3
12+00
RCH 3
AUTHORIZED DEPTH
RECD DEPTH
RECD DEPTH
-35'
-38'

ALT C1 - Sediment: 678K CY | Rock: 160K CY | PNA:19.6 AC

ALT C2 - Sediment: 598K CY | Rock: 149K CY | PNA:19.0 AC

ALT C3 - Sediment: 454K CY | Rock: 178K CY | PNA:18.6 AC

Wilmington District

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA

MAY 20 1775

General Reevaluation Report

- **Turning Basins Technical Issues:**
  - Navigation needs
  - Shoaling analysis – C3 less
  - Ship simulation waiver request
  - Sediment borings
    - Rock and sediment quantities
  - Hydrographic surveys
  - No wetland impacts
  - Primary nursery area impacts
  - Disposal of dredged material Eagle Island or ODMDS
    - Testing still required for relocated basin disposal in ODMDS
  - Cost estimates
  - Economic analyses
  - Hydrodynamic modeling for mitigation alternatives
  - No real estate issues for turning basin but some for mitigation alternatives

Wilmington District

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA MAY 20 1775 ESSE QUAM VIDERI

General Reevaluation Report

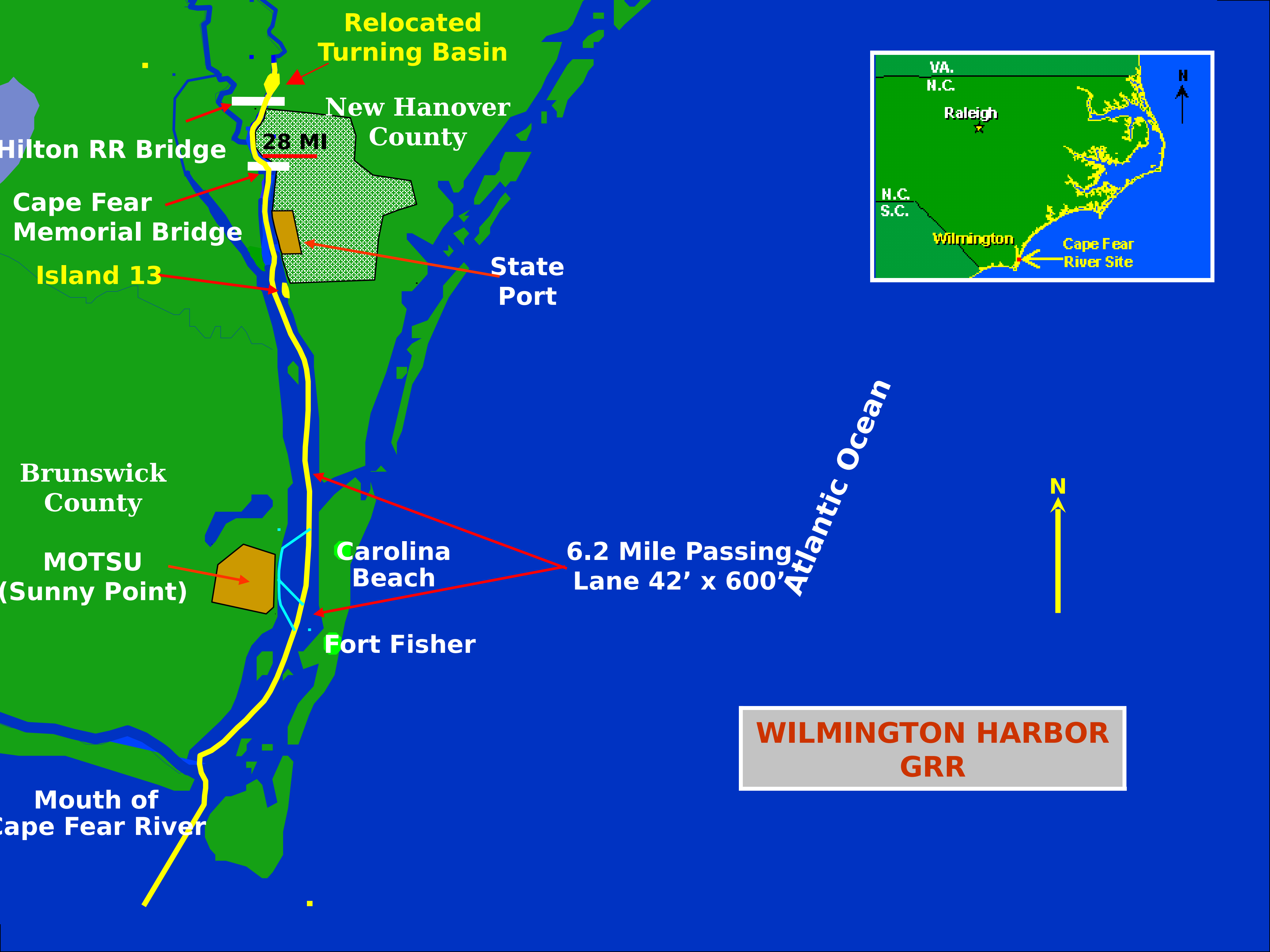
- **Turning Basins Alternatives:**
  - **No action – Construct two authorized basins**
    - **Ships still must pass stern first through the bridges**
    - $23.1 million (construction, maintenance & mitigation)
  - **C3 preferred by pilots – safety and time savings**
  - **B1 preferred by environmental agencies**
    - **Less mitigation requirements**
      - **B1 impacts 8.8 acres PNA ~ 4 HU’s**
      - **C3 impacts 18.6 acres PNA ~ 10 HU’s**
    - **However B1 total costs more (construction, maintenance & mitigation)**
      - **B1 $28.5 million**
      - **C3 $20.7 million**
    - **Congressional approval if selected**
  - **C3 selected alternative**
  - **Mitigation**

Wilmington District

General Reevaluation Report

- **C3 Turning Basin Mitigation Alternatives:**
  - Mitigation
    - Restoration
      - Island 13
      - Island 12 – three alternative sizes
      - Alligator Creek
    - Fish Passage – enhances estuarine/PNA resources
      - Lock and Dam # 2
      - Lock and Dam # 3
      - Lock and Dam # 1 already required under NMFS BO indicated below

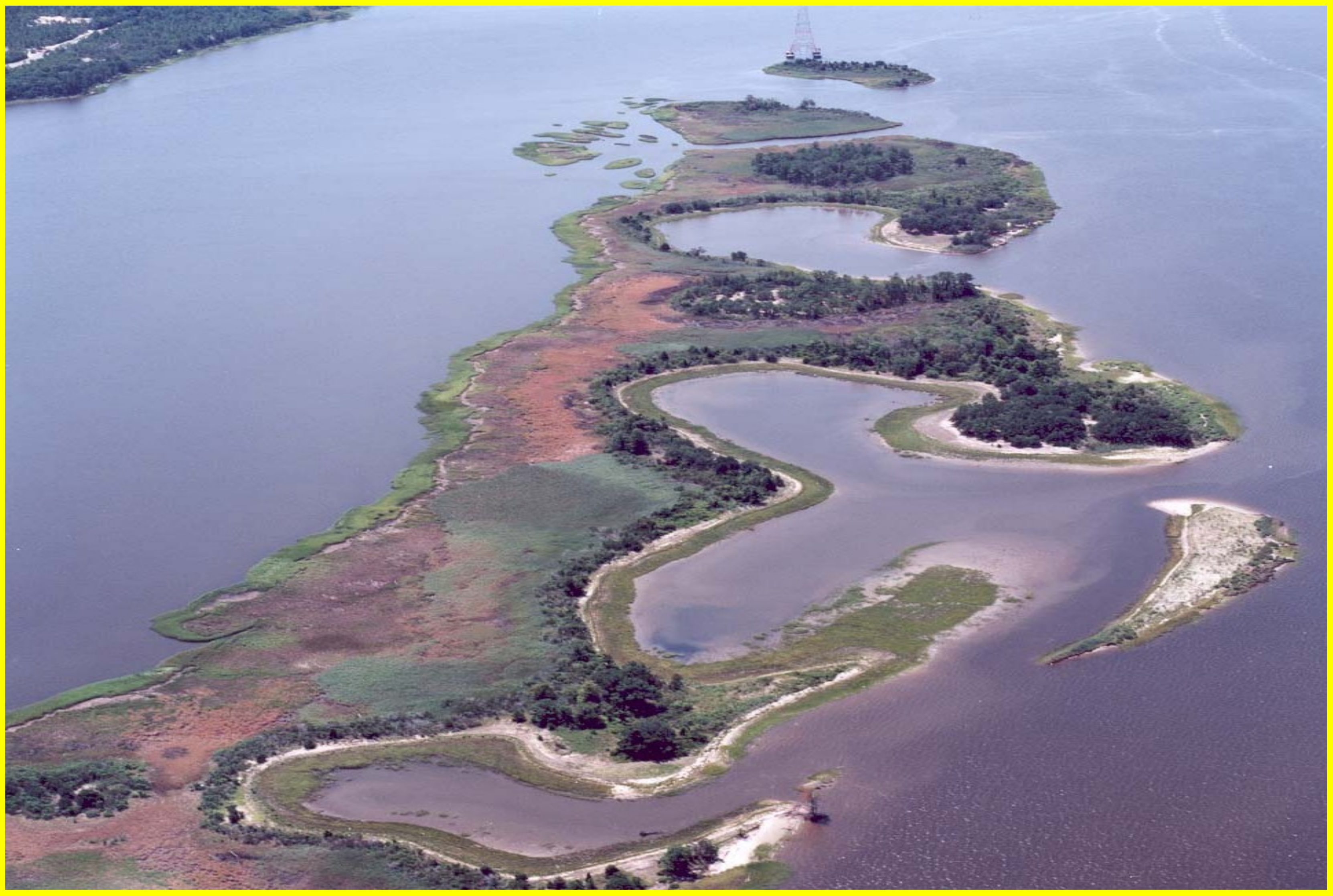
WILMINGTON HARBOR GRR


Relocated Turning Basin
New Hanover County
28 MI
Hilton RR Bridge
Cape Fear Memorial Bridge
Island 13
State Port
Brunswick County
MOTSU (Sunny Point)
Carolina Beach
Fort Fisher
6.2 Mile Passing Lane 42' x 600'
Atlantic Ocean
N
Mouth of Cape Fear River
VA.
N.C.
Raleigh
N
N.C.
S.C.
Wilmington
Cape Fear River Site

Wilmington District

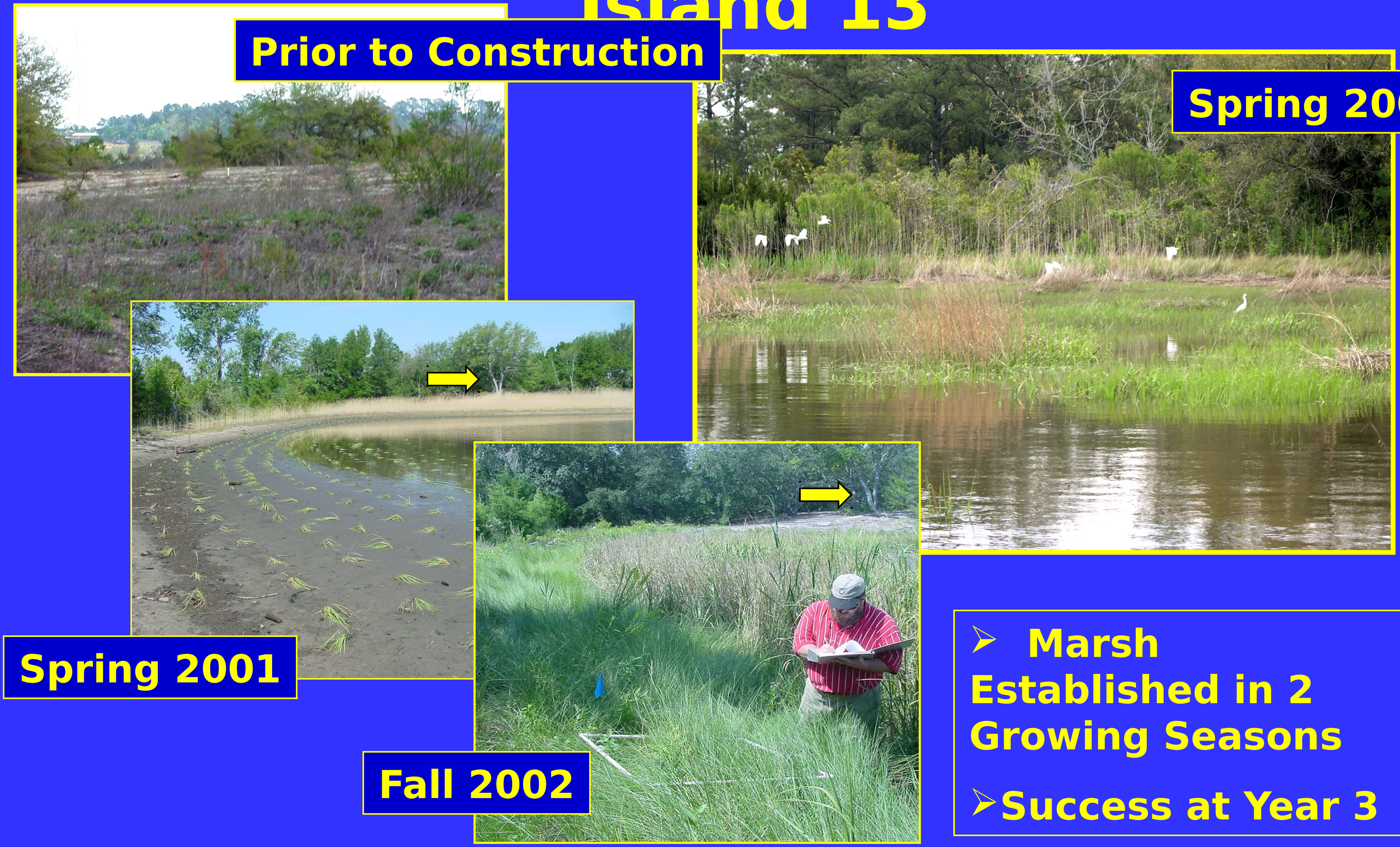
Relocated Turning Basin

Mitigation Options, Island 13



Wilmington District

Ecosystem Establishment Island 13



Prior to Construction

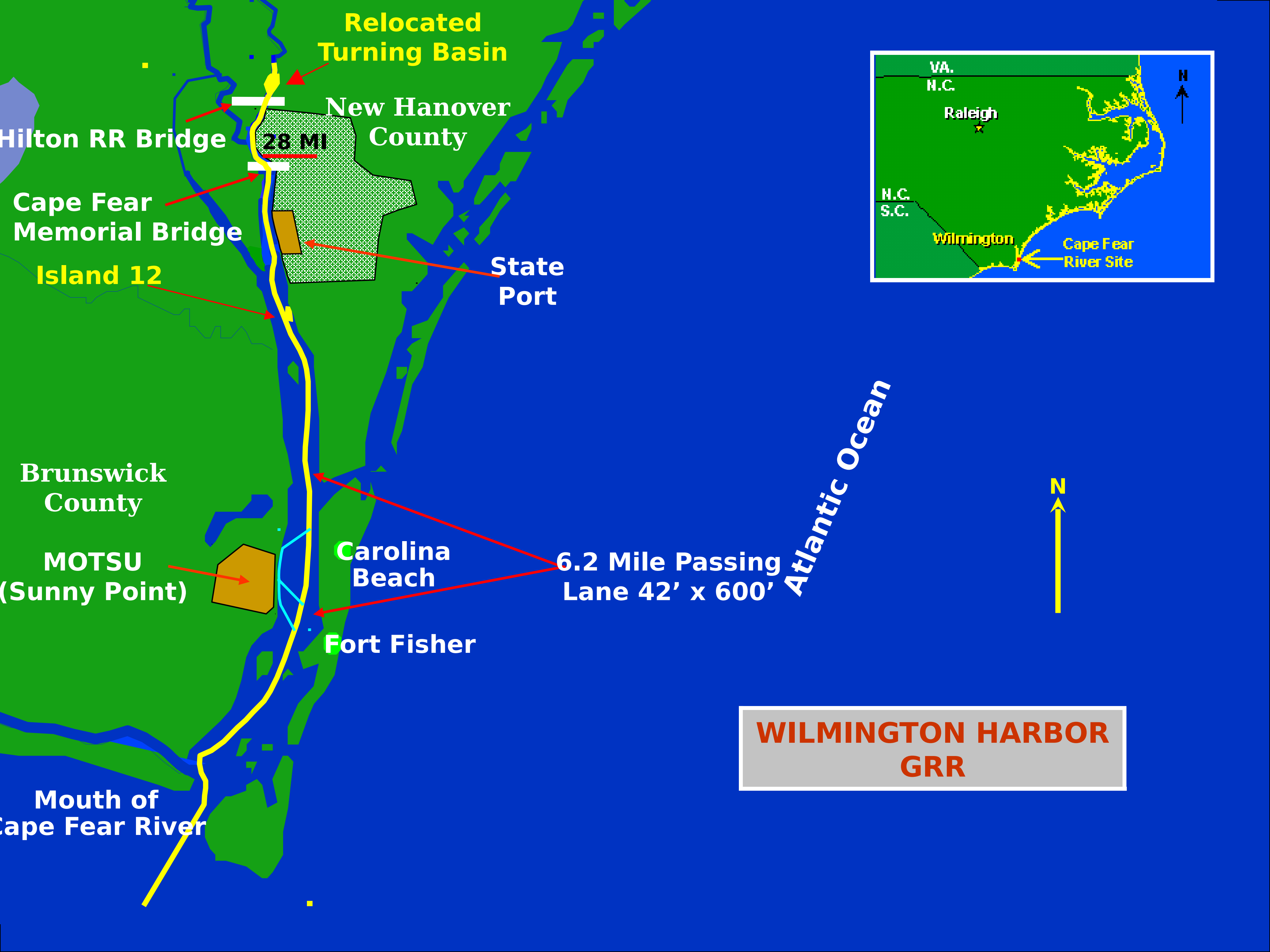
Spring 2004

Spring 2001

Fall 2002

- Marsh Established in 2 Growing Seasons
- Success at Year 3

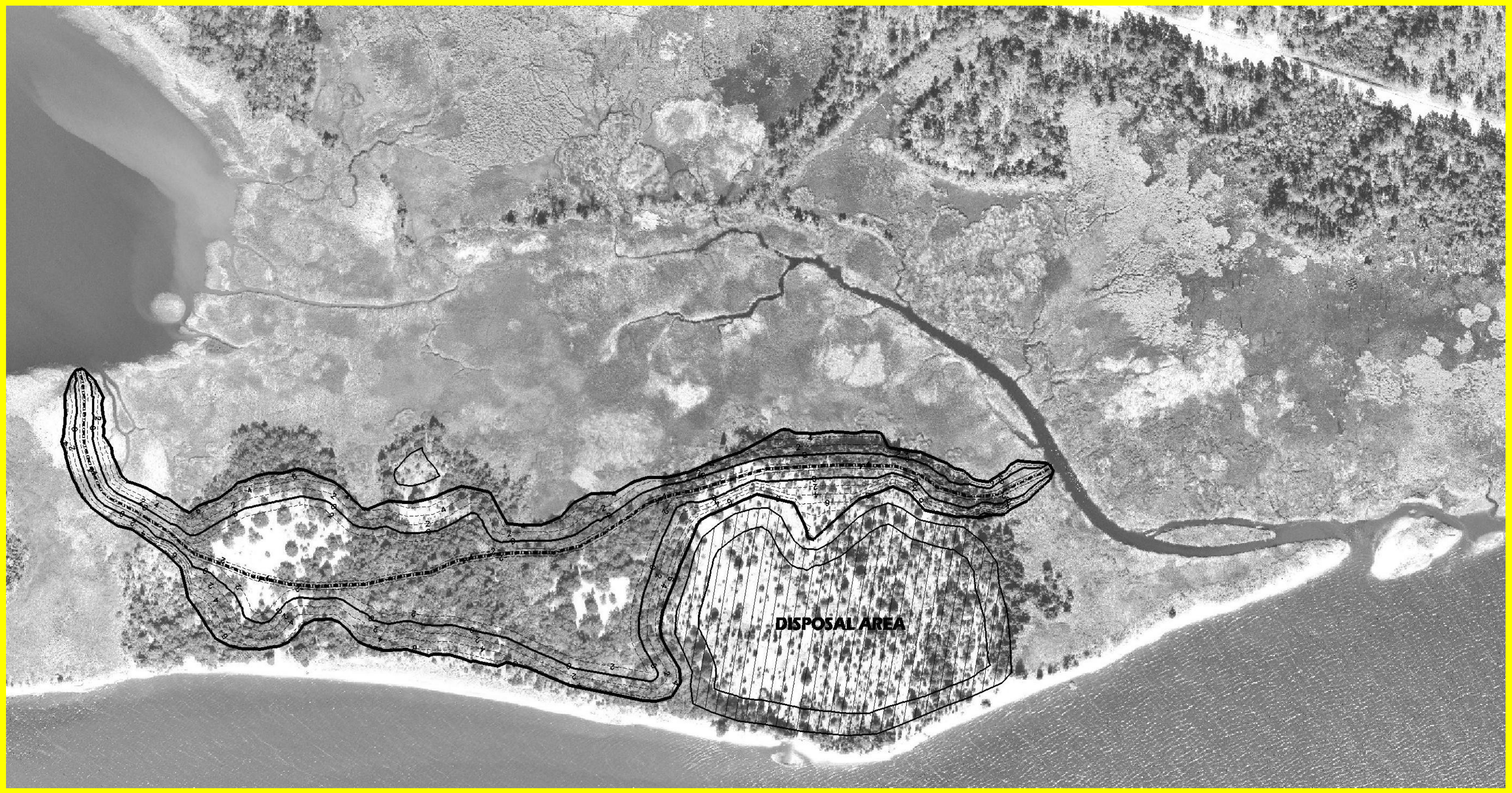
WILMINGTON HARBOR GRR


Relocated
Turning Basin
New Hanover
County
Hilton RR Bridge
28 MI
Cape Fear
Memorial Bridge
Island 12
State
Port
Brunswick
County
MOTSU
(Sunny Point)
Carolina
Beach
6.2 Mile Passing
Lane 42’ x 600’
Fort Fisher
Atlantic Ocean
N
Mouth of
ape Fear River
VA.
N.C.
Raleigh
N.C.
S.C.
Wilmington
Cape Fear
River Site
N

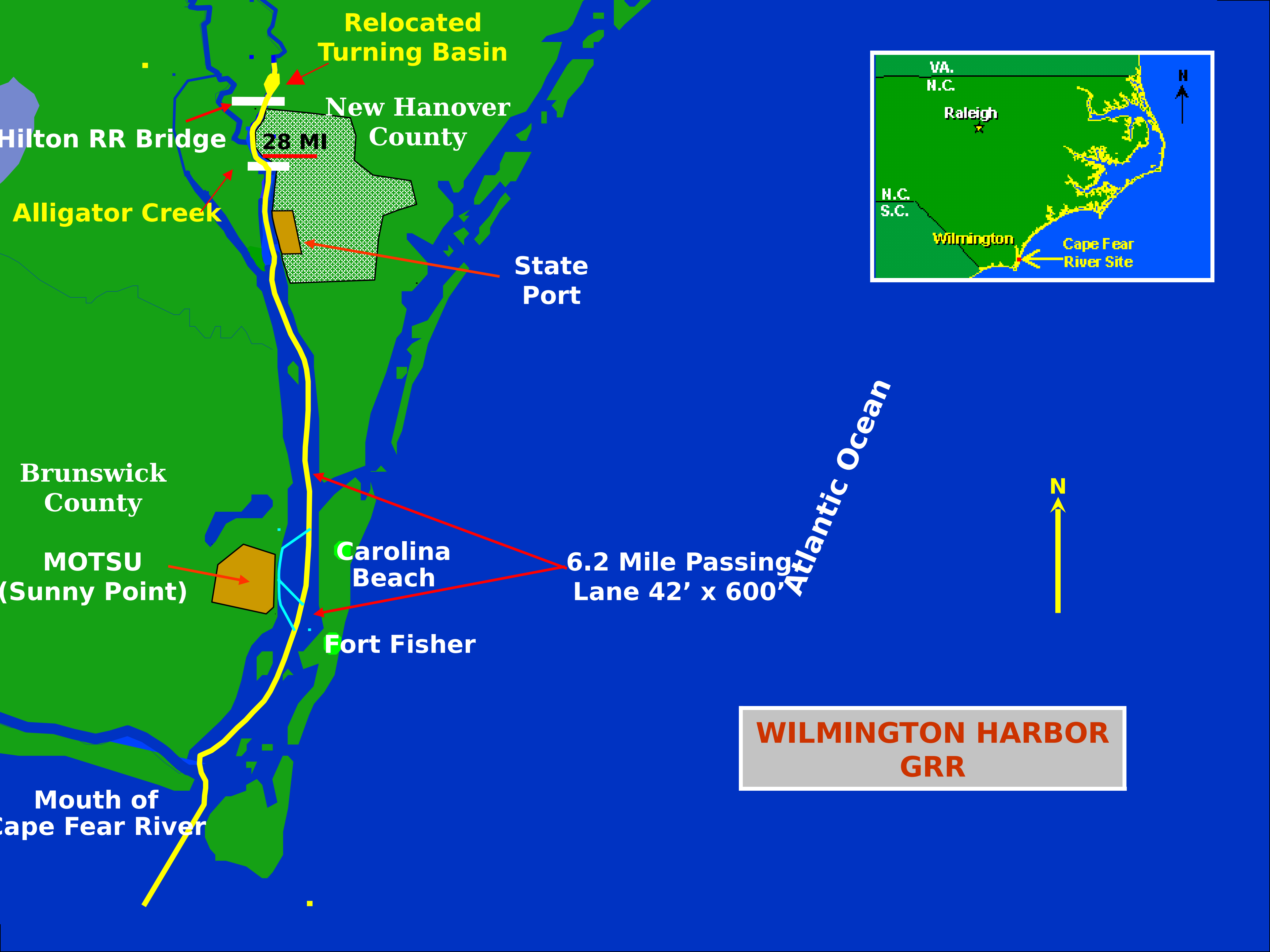
Wilmington District

Relocated Turning Basin

Mitigation Options, Island 12


DISPOSAL AREA

WILMINGTON HARBOR GRR

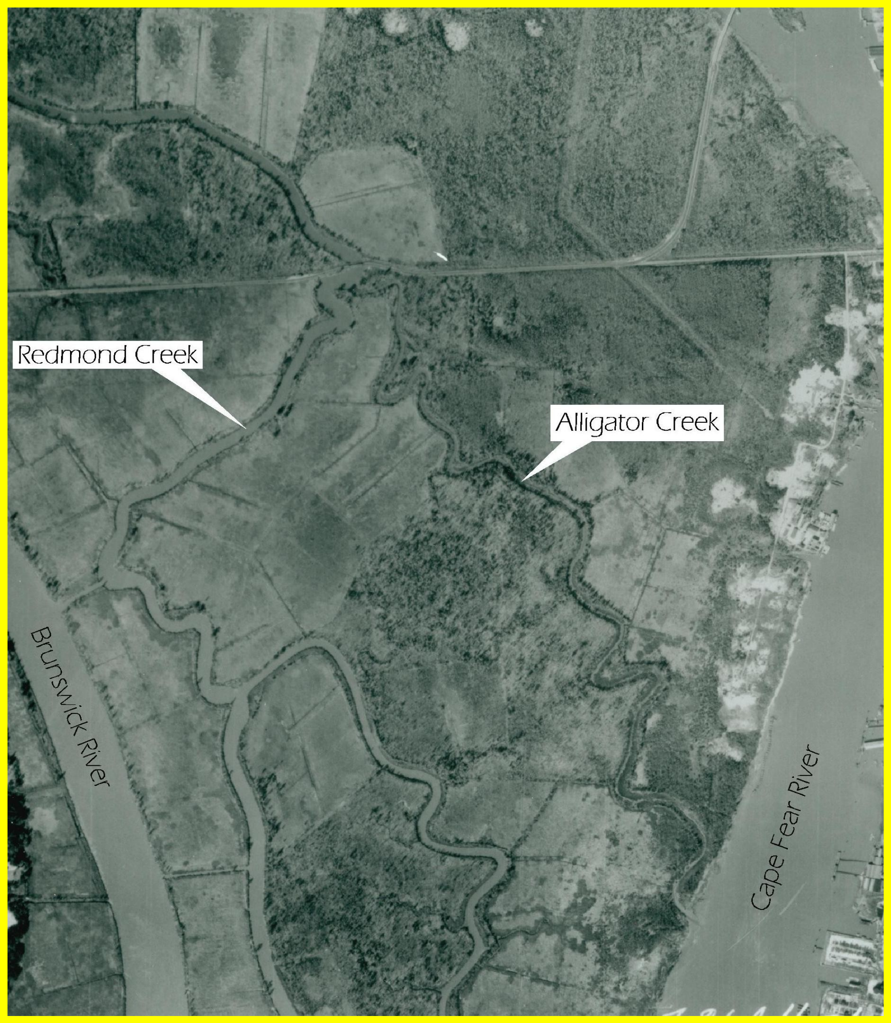

Relocated Turning Basin
New Hanover County
Hilton RR Bridge
28 MI
Alligator Creek
State Port
Brunswick County
MOTSU (Sunny Point)
Carolina Beach
6.2 Mile Passing Lane 42’ x 600’
Atlantic Ocean
Fort Fisher
N
Mouth of Cape Fear River
VA.
N.C.
Raleigh
N.C.
S.C.
Wilmington
Cape Fear River Site
N

Wilmington District

Relocated Turning Bas

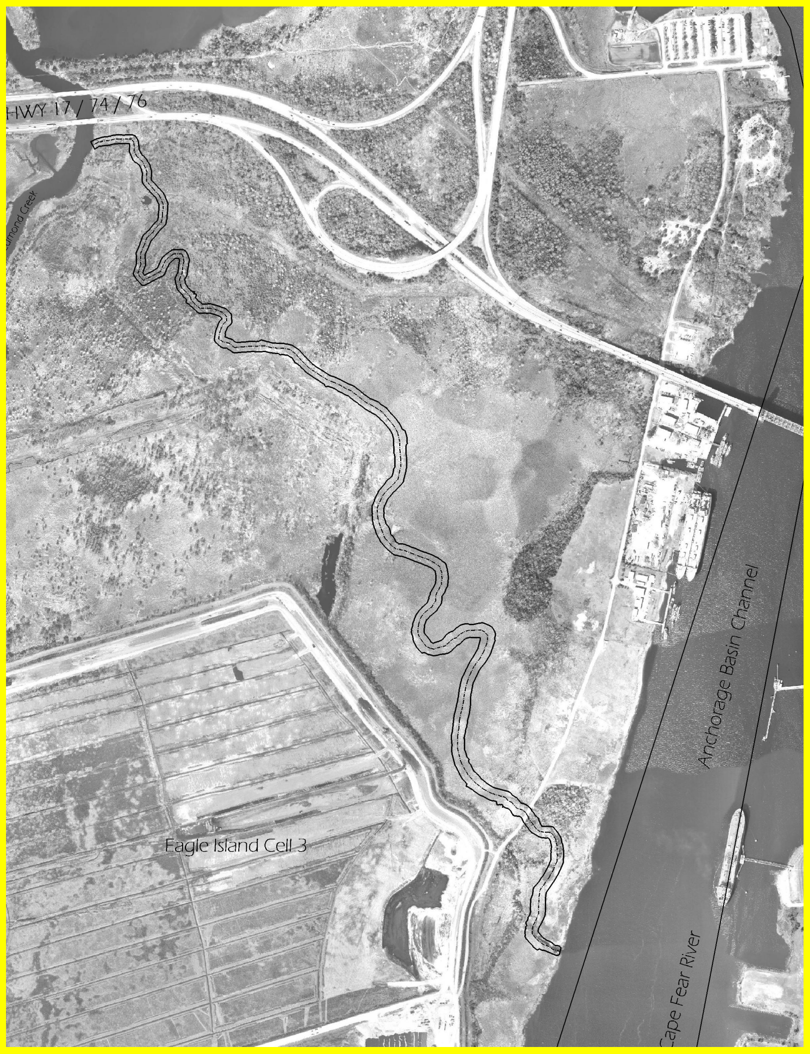
Mitigation Options, Alligator Creek

~ 1940

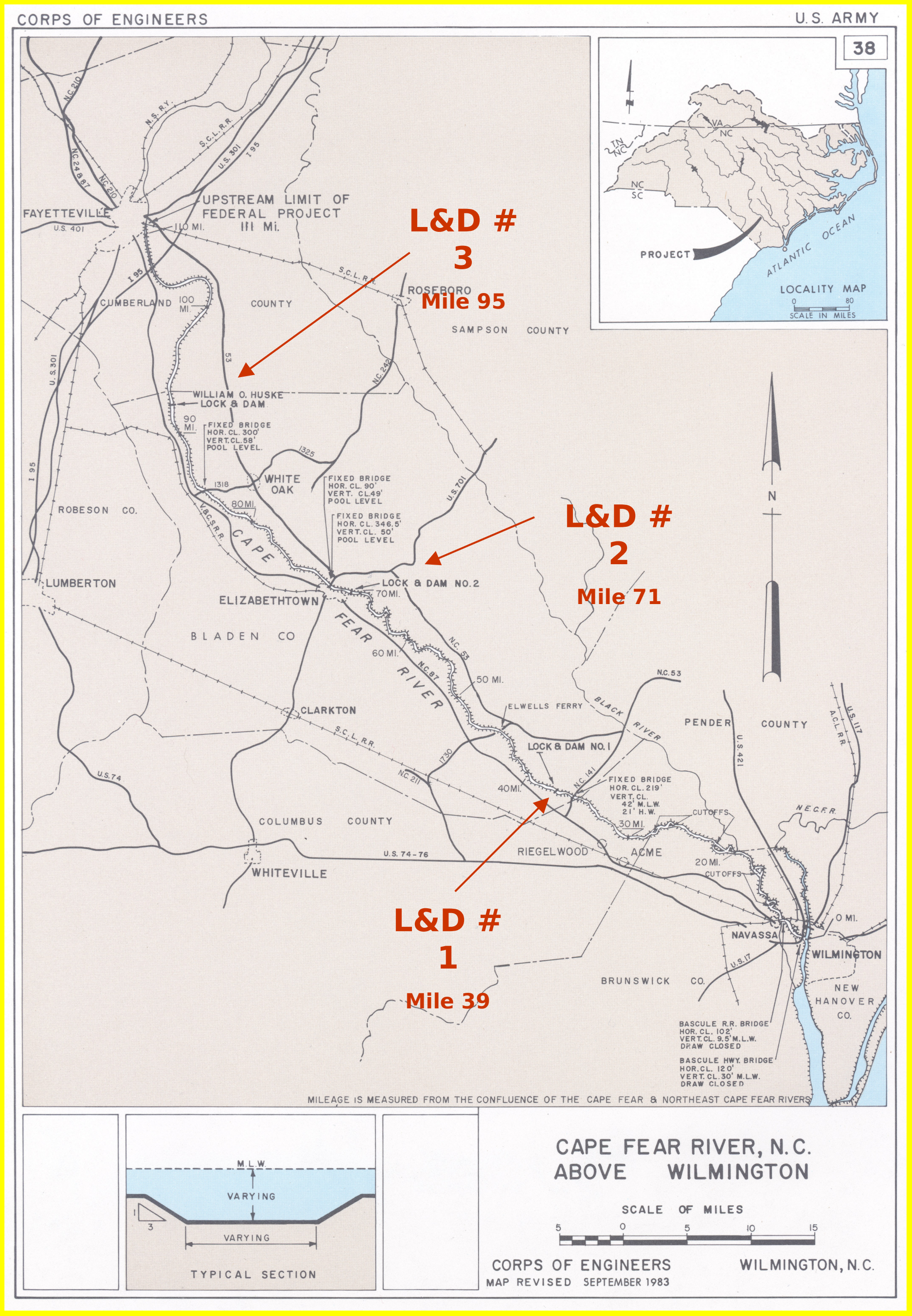

Redmond Creek
Alligator Creek
Brunswick River
Cape Fear River

Wilmington District

Relocated Turning Bas Mitigation Options, Alligator Creek


HWY 17 / 74 / 76
mond Creek
Eagle Island Cell 3
Anchorage Basin Channel
ape Fear River

Wilmington District


L&D # 3
Mile 95

L&D # 2
Mile 71

L&D # 1
Mile 39

CORPS OF ENGINEERS
U.S. ARMY
38
LOCALITY MAP
PROJECT
ATLANTIC OCEAN
VA
NC
TN
SC
SCALE IN MILES
FAYETTEVILLE
UPSTREAM LIMIT OF FEDERAL PROJECT 111 MI.
110 MI.
100 MI.
90 MI.
80 MI.
70 MI.
60 MI.
50 MI.
40 MI.
30 MI.
20 MI.
0 MI.
CUMBERLAND COUNTY
SAMPSON COUNTY
ROSEBORO
WILLIAM O. HUSKE LOCK & DAM
FIXED BRIDGE HOR. CL. 300' VERT. CL. 58' POOL LEVEL
WHITE OAK
FIXED BRIDGE HOR. CL. 90' VERT. CL. 49' POOL LEVEL
FIXED BRIDGE HOR. CL. 346.5' VERT. CL. 50' POOL LEVEL
ROBESON CO.
LUMBERTON
ELIZABETHTOWN
LOCK & DAM NO. 2
BLADEN CO
CAPE FEAR RIVER
CLARKTON
ELWELLS FERRY
BLACK RIVER
PENDER COUNTY
LOCK & DAM NO. 1
FIXED BRIDGE HOR. CL. 219' VERT. CL. 42' M.L.W. 21' H.W.
CUTOFFS
COLUMBUS COUNTY
WHITEVILLE
RIEGELWOOD
ACME
NAVASSA
WILMINGTON
BRUNSWICK CO.
NEW HANOVER CO.
BASCULE R.R. BRIDGE HOR. CL. 102' VERT. CL. 9.5' M.L.W. DRAW CLOSED
BASCULE HWY. BRIDGE HOR. CL. 120' VERT. CL. 30' M.L.W. DRAW CLOSED
N
MILEAGE IS MEASURED FROM THE CONFLUENCE OF THE CAPE FEAR & NORTHEAST CAPE FEAR RIVERS
M.L.W.
VARYING
VARYING
TYPICAL SECTION
CAPE FEAR RIVER, N.C.
ABOVE WILMINGTON
SCALE OF MILES
CORPS OF ENGINEERS
WILMINGTON, N.C.
MAP REVISED SEPTEMBER 1983

Wilmington District

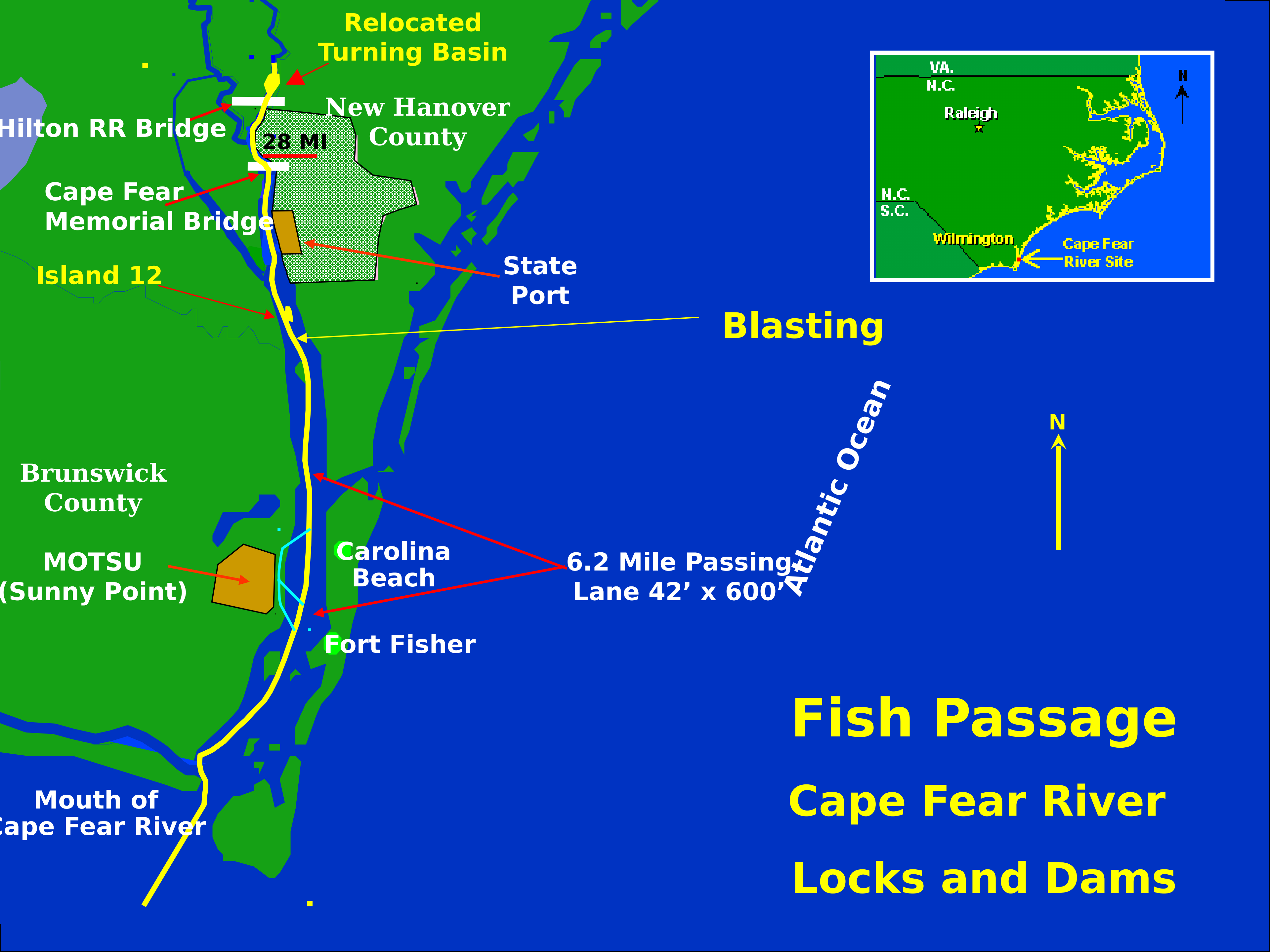
THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20 1775
ESSE QUAM VIDERI

Relocated Turning Bas

Mitigation Options, Fish Passage
Cape Fear River Locks and Dams

Lock and Dam # 2

Lock and Dam # 3


Relocated Turning Basin
New Hanover County
Hilton RR Bridge
28 MI
Cape Fear Memorial Bridge
State Port
Island 12
Blasting
Atlantic Ocean
N
Brunswick County
MOTSU (Sunny Point)
Carolina Beach
6.2 Mile Passing Lane 42’ x 600’
Fort Fisher
Mouth of Cape Fear River
VA.
N.C.
Raleigh
N
N.C.
S.C.
Wilmington
Cape Fear River Site

Fish Passage

Cape Fear River

Locks and Dams

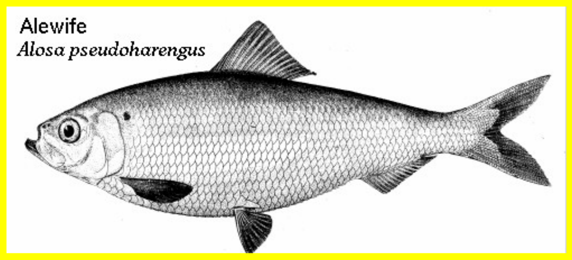
Rock Blasting

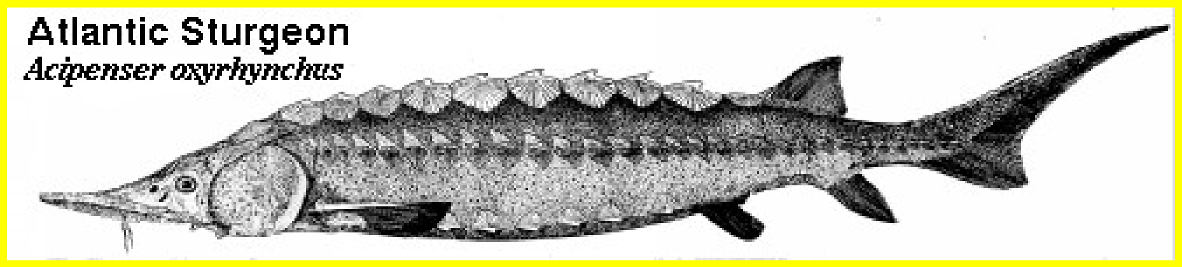
- NMFS 2000 Biological Opinion (BO) under the Endangered Species Act
    - Lock and Dams reduce access to traditional spawning areas for the endangered shortnose sturgeon
    - Reasonable and Prudent Measures
        - Construct fish passage at Lock and Dam #1 for shortnose sturgeon
        - Only Study feasibility of fish passage at Locks and Dams # 2 & 3
            - Fish passage construction available for mitigation for C3 turning basin
- Blasting precluded without measures
- 78 blasts to date
- Additional blasting may occur

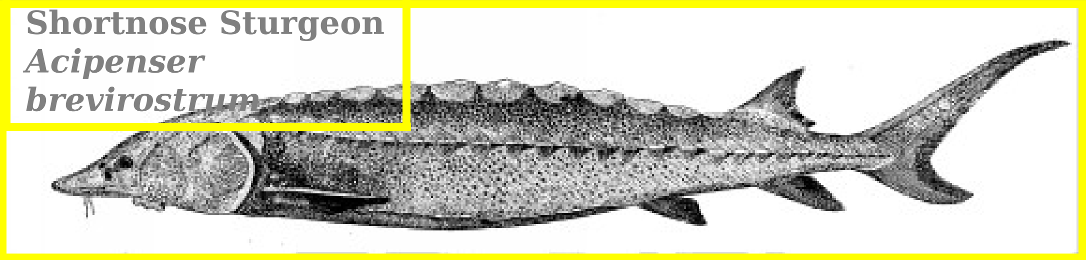
Wilmington District

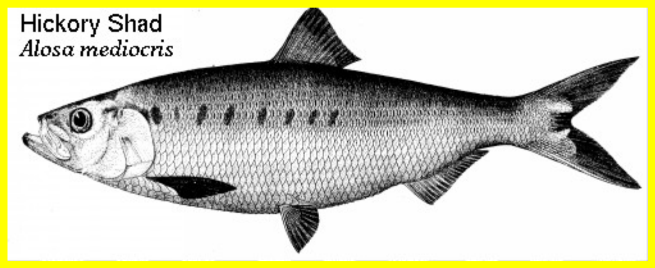
North Carolina Anadromous Fish

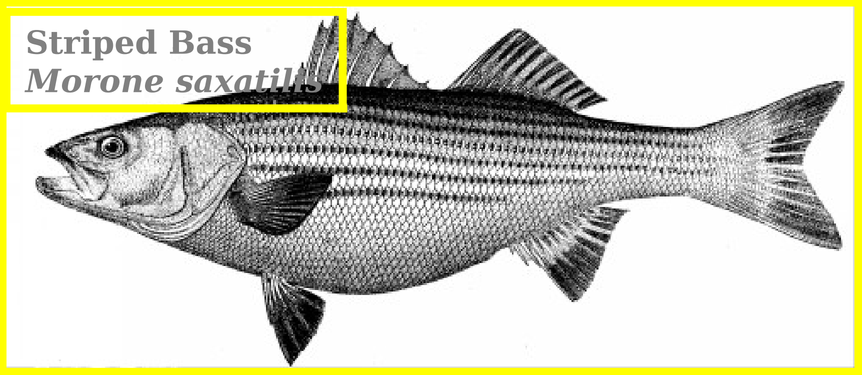
MAY 20 1775

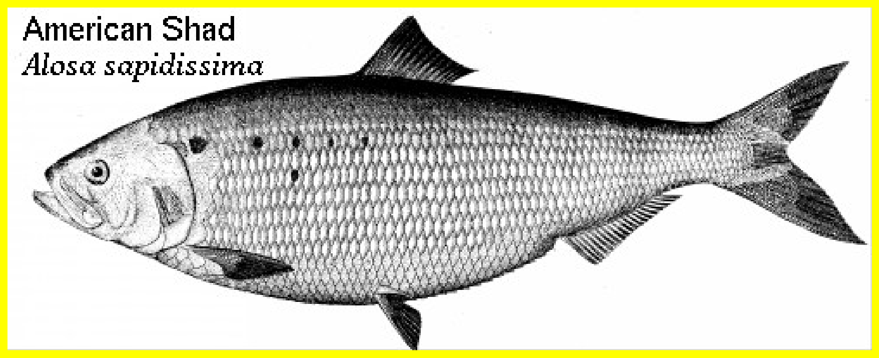

Alewife
Alosa pseudoharengus


Atlantic Sturgeon
Acipenser oxyrhynchus


Shortnose Sturgeon
Acipenser brevirostrum


Hickory Shad
Alosa mediocris


Striped Bass
Morone saxatilis


American Shad
Alosa sapidissima

Wilmington District

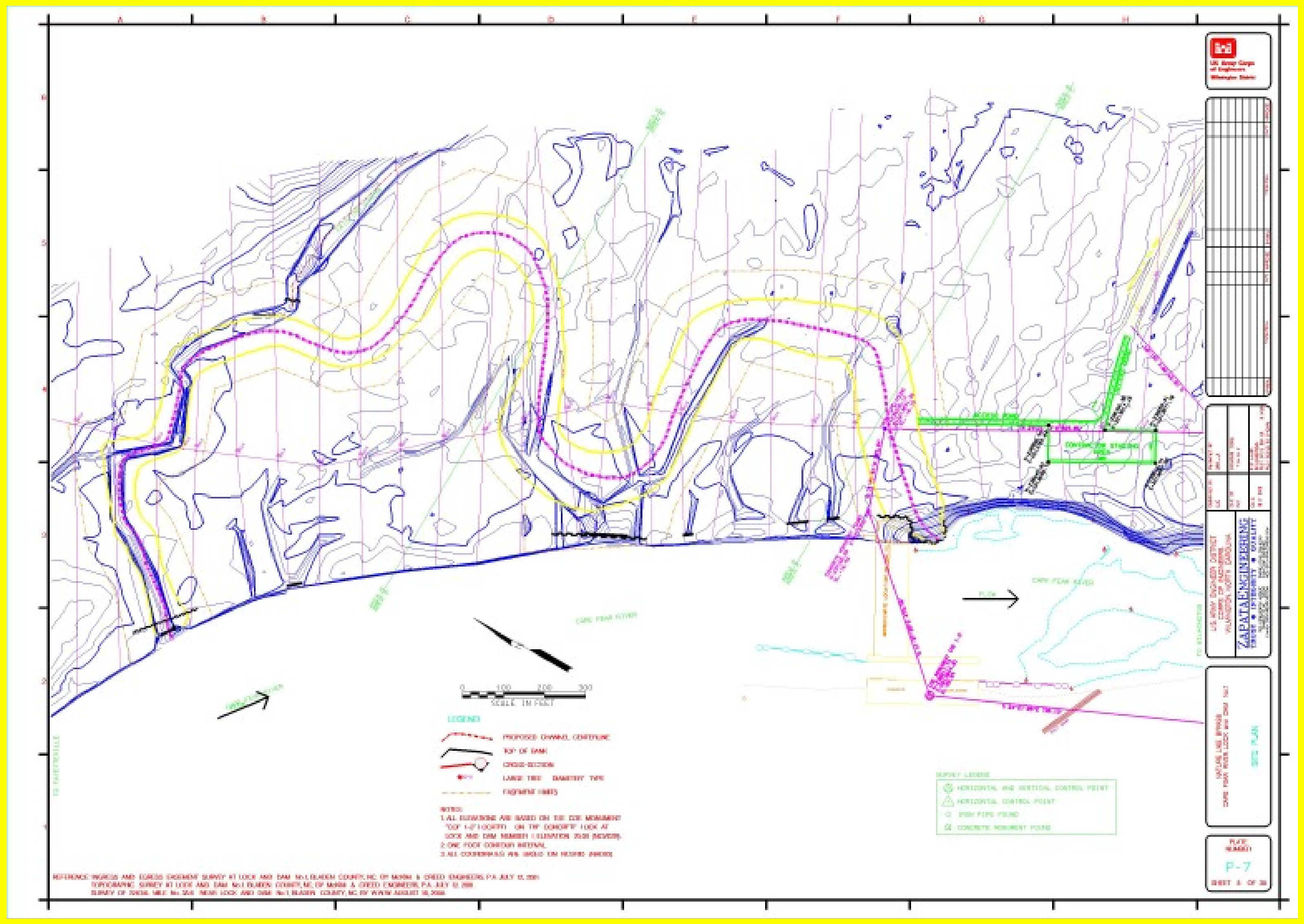
THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20 1775

General Reevaluation Report

- **Initial Assumptions under NMFS BO:**
  - Locks and Dams project purpose of navigation could not be compromised
  - Alternatives considered
    - Improve locking procedures
    - Rock rapids
    - Diversion channel
    - Nature-like bypass
      - Least cost
      - Acceptable to all parties
      - Real estate and funding issues

Wilmington District

Bypass Design



CAPE FEAR RIVER
FLOW
0 100 200 300
SCALE IN FEET
LEGEND
PROPOSED CHANNEL CENTERLINE
TOP OF BANK
CROSS-SECTION
LARGE TREE DIAMETER TYPE
EASEMENT LIMITS
NOTES:
P-7

Better Fish Passage Alternatives?

- **No commercial traffic**
- **Operations costs about $500-$600 thousand/year**
- **Locks and Dams have finite life**
- **Better fish passage solution considering:**
  - **Water supply**
  - **Recreation**
  - **Commercial and recreation fishing**

Wilmington District

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20 1775
ESSE QUAM VIDERI

General Reevaluation Report

- **Locks and Dams Technical Issues:**
  - Can not compromise water supply
  - Detailed coordination will all parties
    - Local governments, water users, environmental groups, state and federal agencies
    - Monthly interagency/Corps meetings
  - Alternative analysis for fish passage
  - Sediment and chemical data behind the dams
  - Stability of the locks and dams
  - Salt water intrusion
  - Potential for commercial use of the locks
  - Recreation
  - Wetland impacts
  - Modeling of water level changes if dams altered of removed
  - Hydrographic surveys
  - Spawning areas for anadromous fish
  - Future ownership of the locks and dams and recreation areas
  - Quantities and Cost estimates
  - Boat docks and ramps

Wilmington District

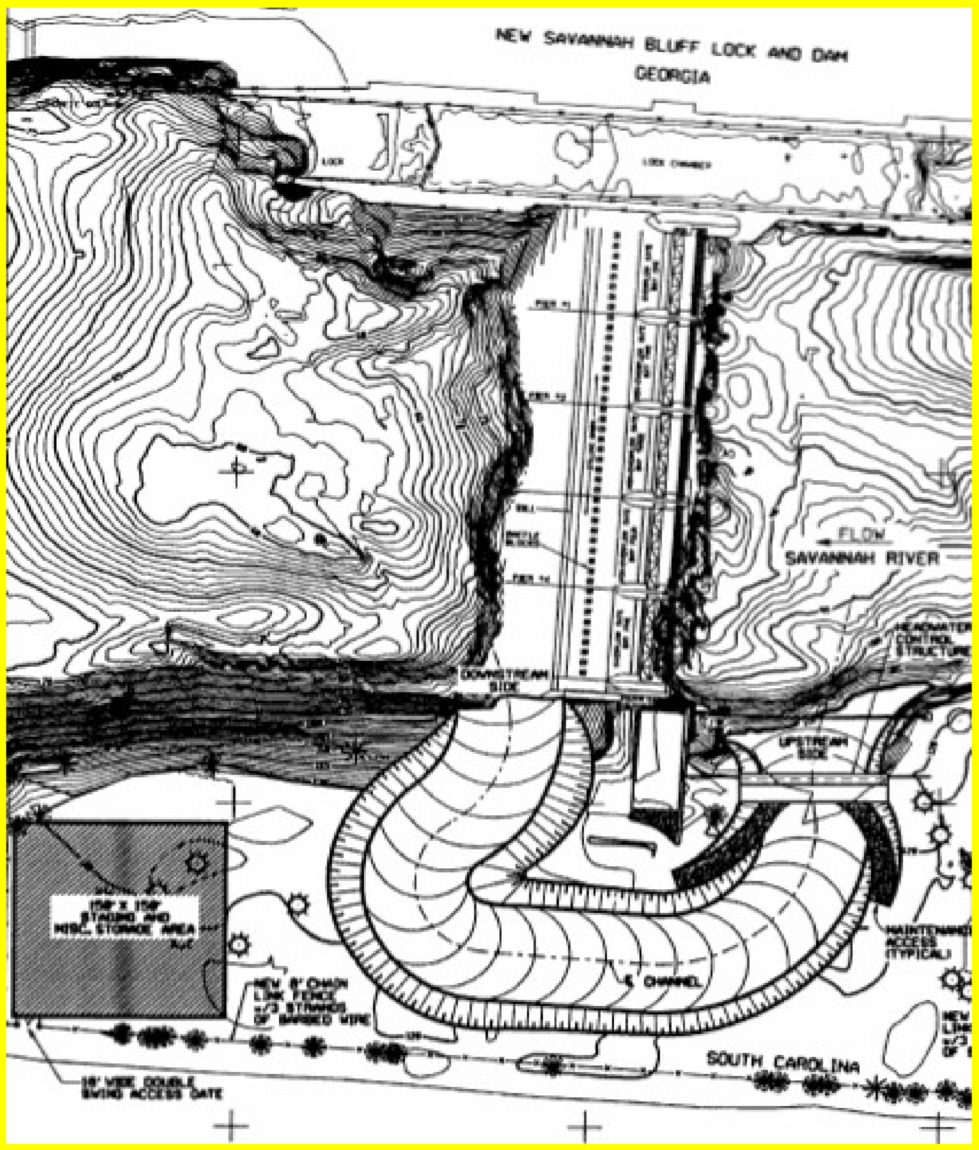
THE GREAT SEAL OF THE STATE OF NORTH CAROLINA MAY 20 1775 ESSE QUAM VIDERI

Fish Passage

- **Fish passage at Locks and Dams:**
  - **No Action – Continue locking at # 2 & 3, fish NMFS 2000 BO**
  - **Passage does not require deauthorization**
    - **Continue locking**
    - **Nature-like fish way**
    - **Diversion rock rapids**
    - **Rock rapids the entire downstream face of the dam**
  - Passage requires deauthorization
    - Rock rapids or step pool in lock chamber
    - Alter the dam
    - Remove the dam
  - Regardless of fish passage design, deauthorization may be requested due to lack of Federal interest – no navigation

Wilmington District

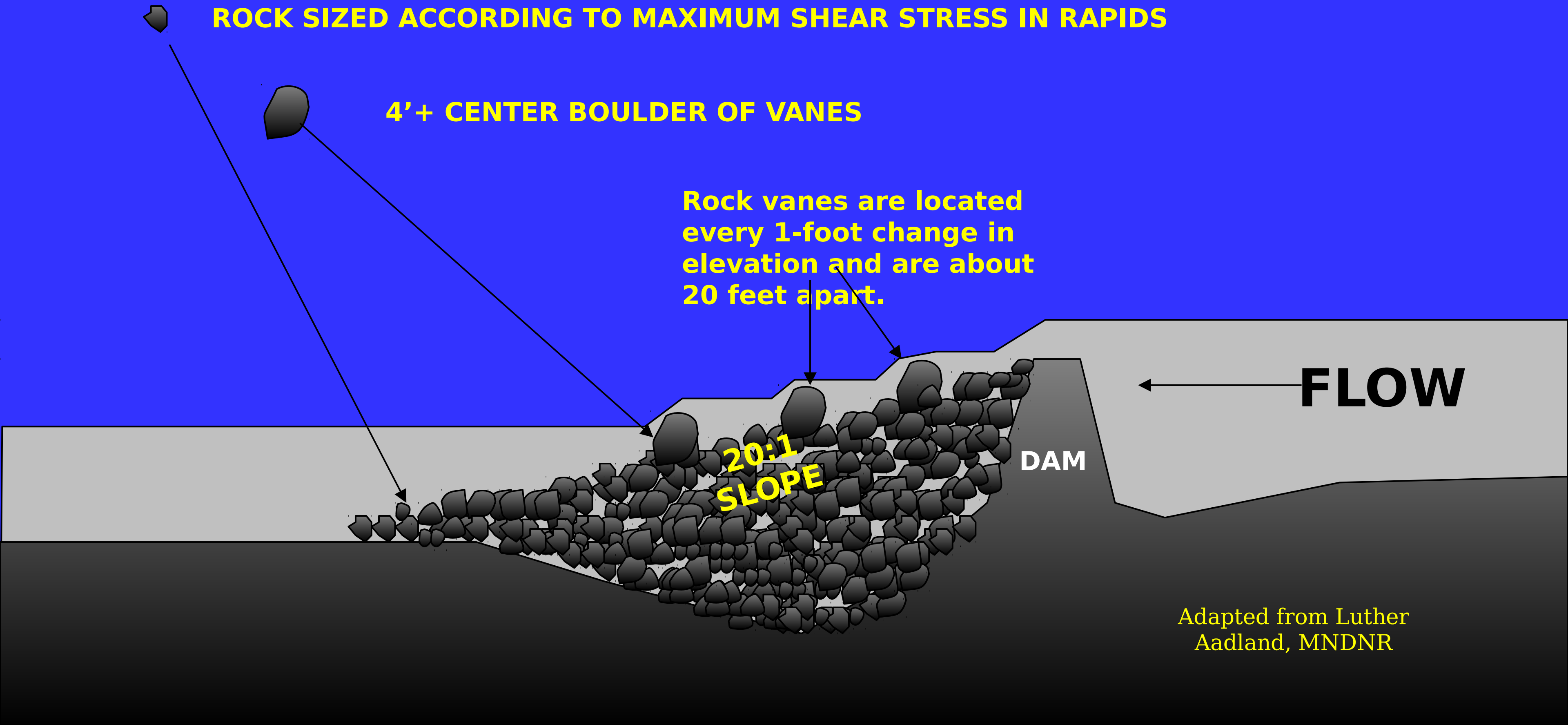
Diversion Rock Rapids


NEW SAVANNAH BLUFF LOCK AND DAM
GEORGIA
LOCK
LOCK CHAMBER
FLOW
SAVANNAH RIVER
HEADWATER CONTROL STRUCTURE
DOWNSTREAM SIDE
UPSTREAM SIDE
150' X 150' STAGING AND MISC. STORAGE AREA
NEW 8' CHAIN LINK FENCE w/3 STRANDS OF BARBED WIRE
℄ CHANNEL
MAINTENANCE ACCESS (TYPICAL)
SOUTH CAROLINA
16' WIDE DOUBLE SWING ACCESS GATE

Wilmington District

Rock Arch Rapids

LONGITUDINAL PROFILE



ROCK SIZED ACCORDING TO MAXIMUM SHEAR STRESS IN RAPIDS

4'+ CENTER BOULDER OF VANES

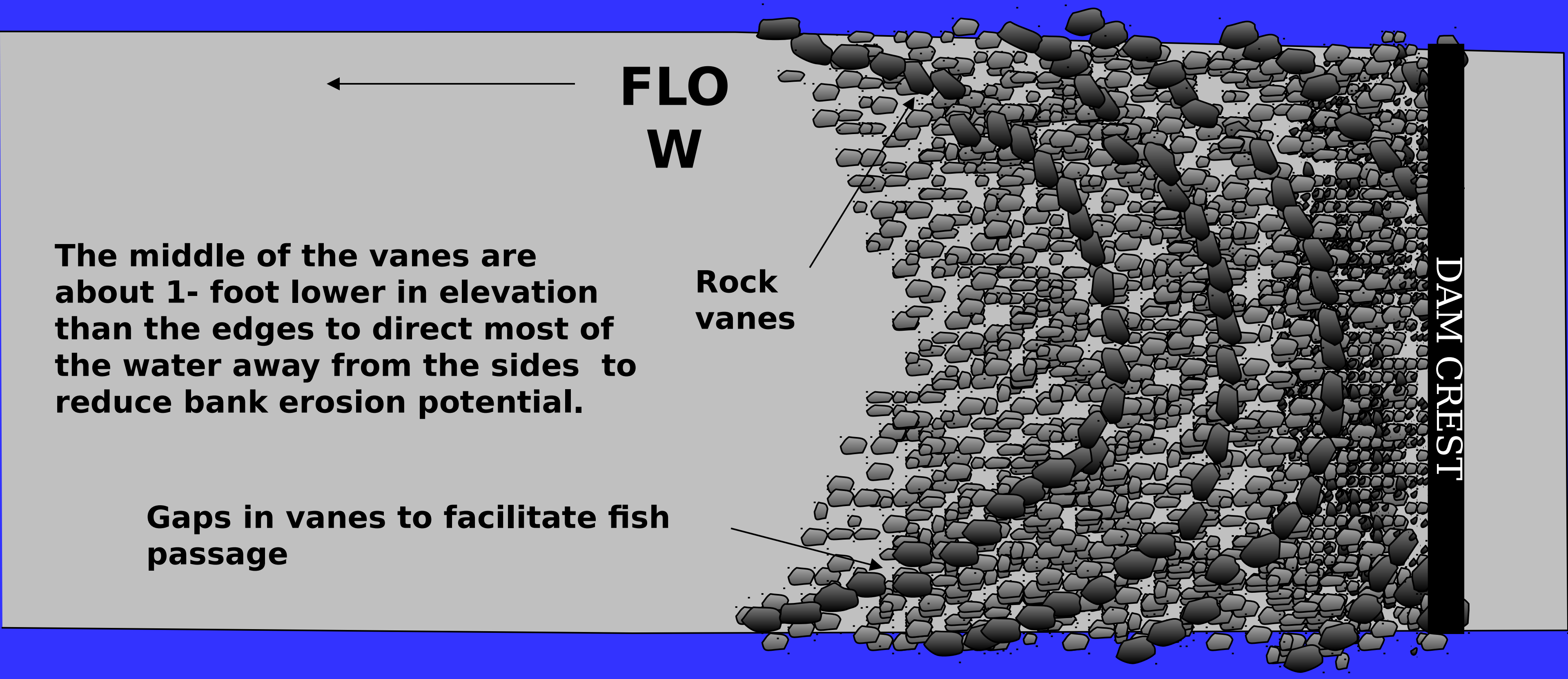
Rock vanes are located every 1-foot change in elevation and are about 20 feet apart.

Adapted from Luther Aadland, MNDNR

Wilmington District

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA MAY 20 1775

Rock Arch Rapids



The middle of the vanes are about 1- foot lower in elevation than the edges to direct most of the water away from the sides to reduce bank erosion potential.

Gaps in vanes to facilitate fish passage

Adapted from Luther Aadland, MNDNR

Wilmington District

Rock Arch Rapids Red River, Fargo, ND

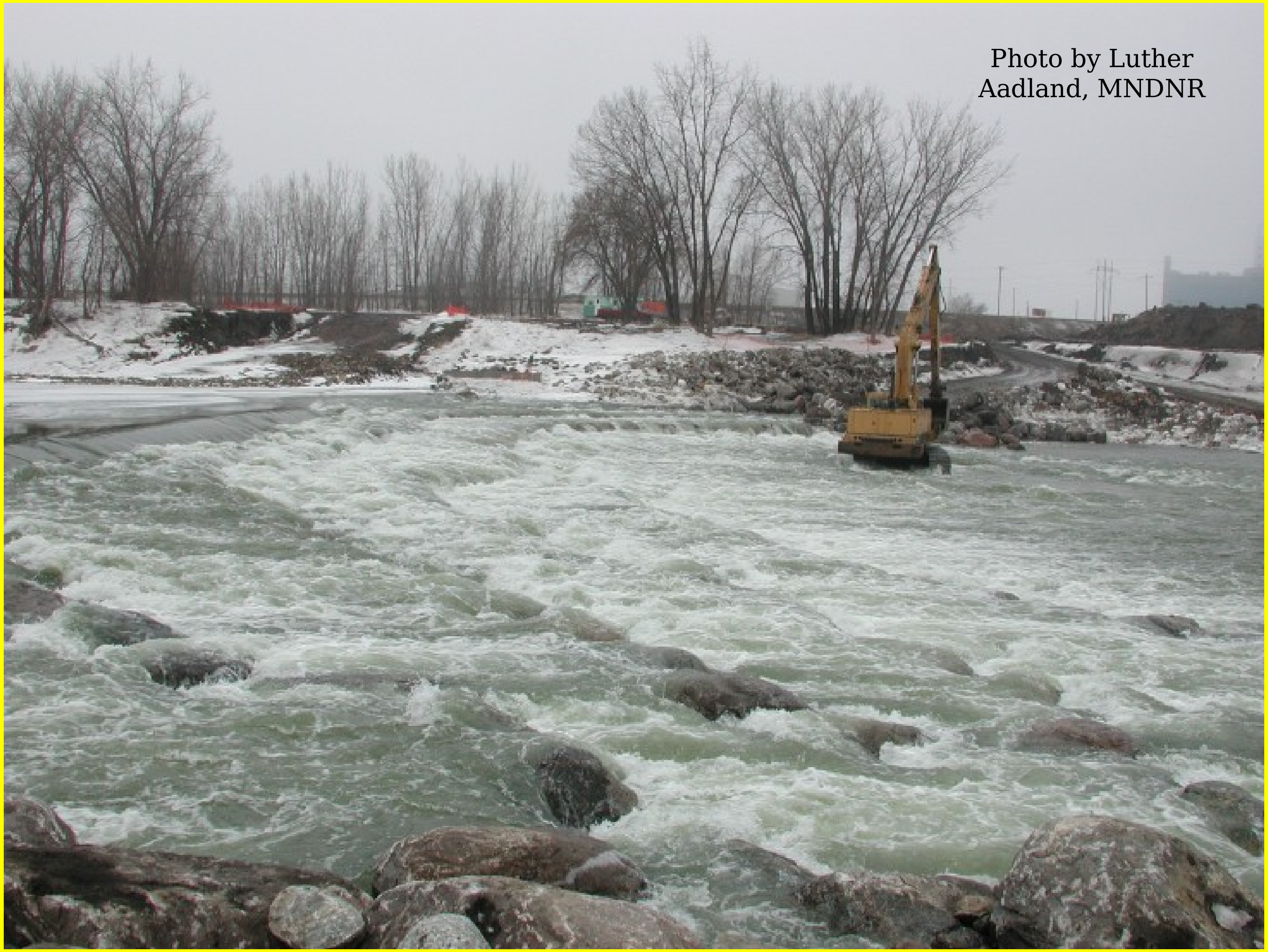


Photo by Luther Aadland, MNDNR

Wilmington District

ST. PAUL DISTRICT
US ARMY CORPS OF ENGINEERS

Rock Arch Rapids
Red River, Fargo, ND

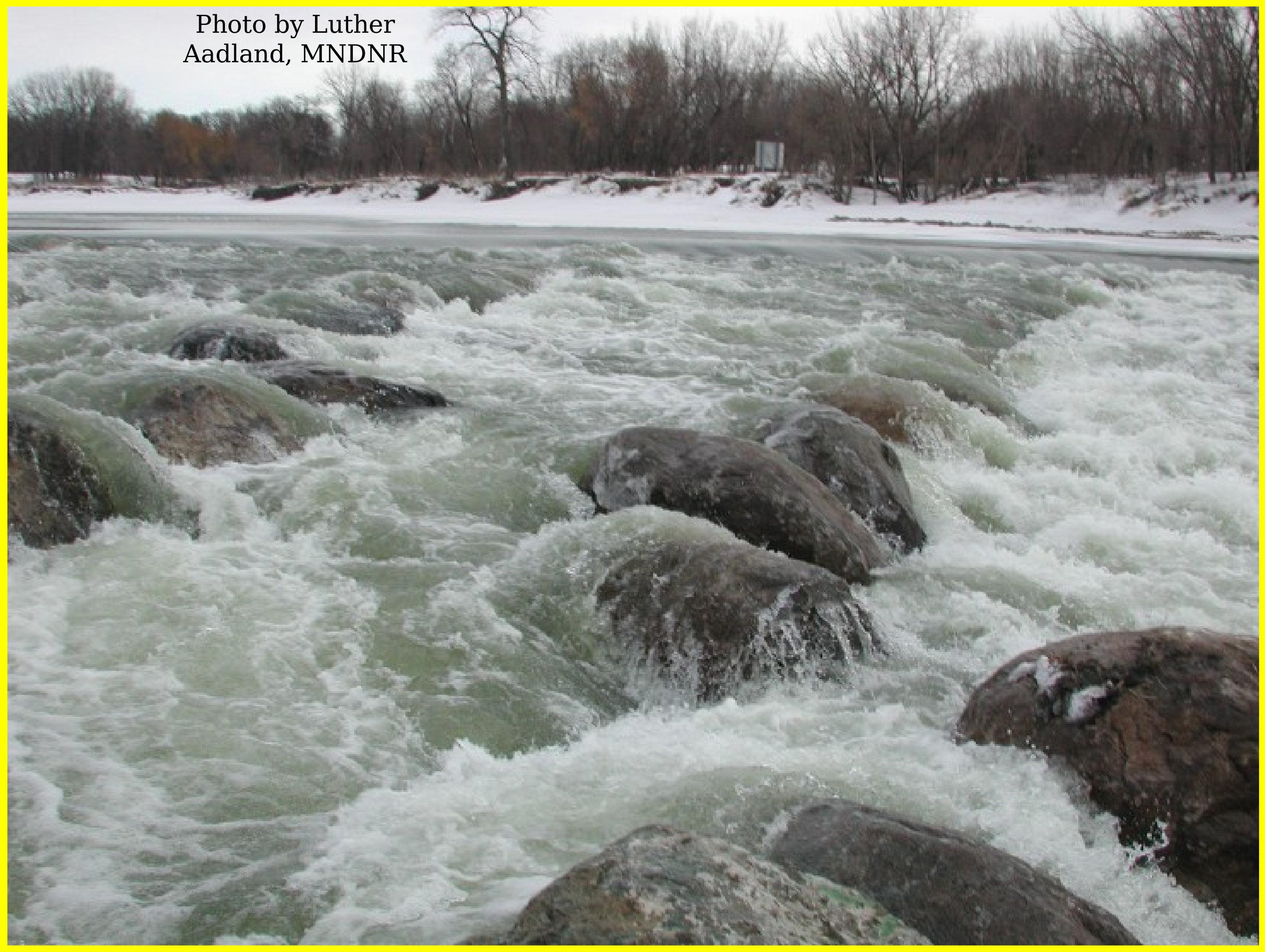


Photo by Luther Aadland, MNDNR

Wilmington District

Riverside Dam

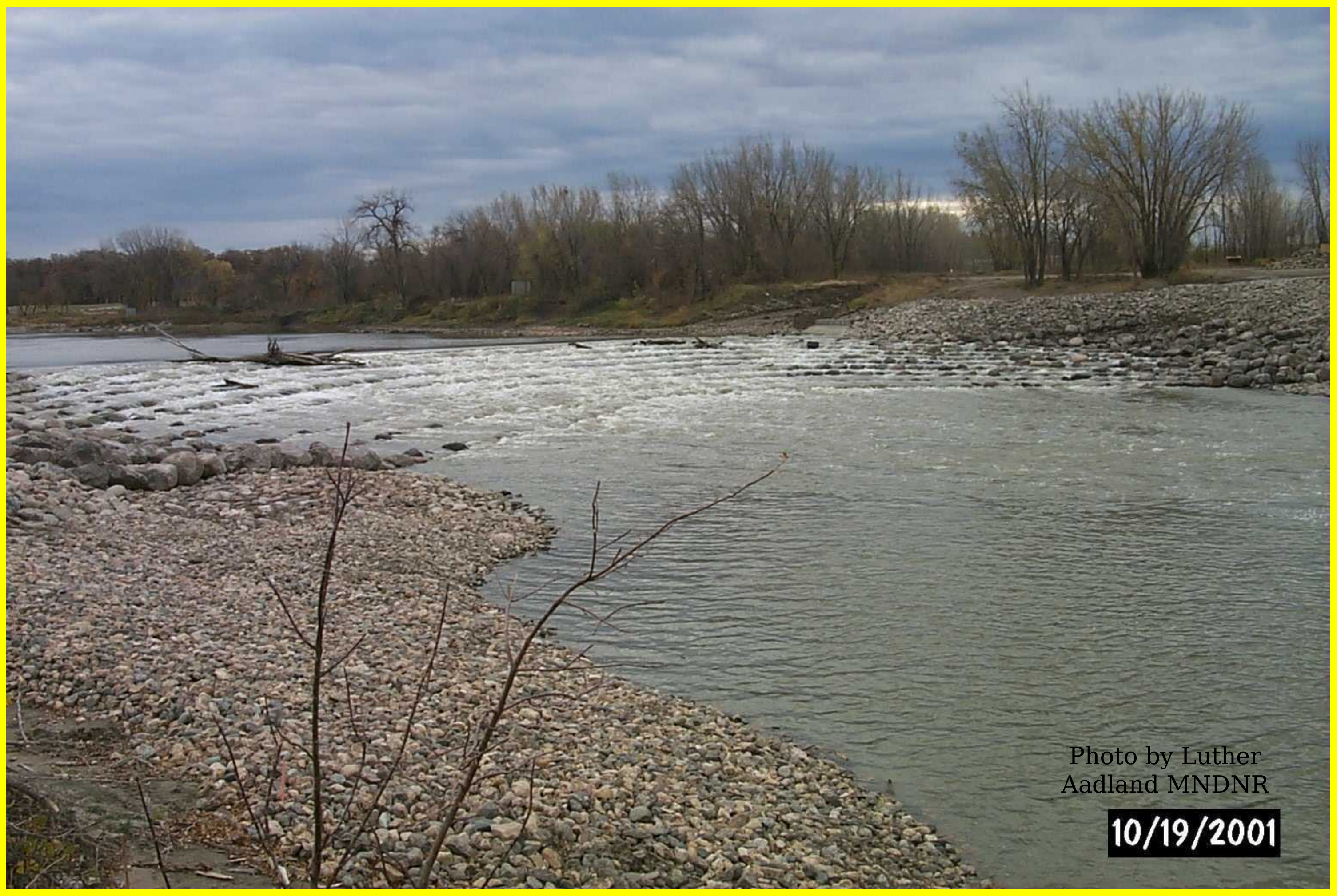
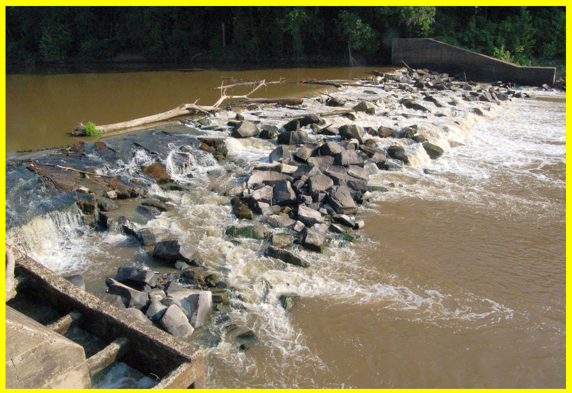


Photo by Luther Aadland MNDNR

10/19/2001

Wilmington District

Fish Passage



- **Fish passage at Locks and Dams:**
  - Passage does not require deauthorization
    - Continue locking
    - Nature-like fish way
    - Diversion rock rapids
    - Rock rapids the entire downstream face of the dam
  - **Passage requires deauthorization**
    - **Rock rapids or step pool in lock chamber**
    - **Lower the dam**
    - **Remove the dam**
  - **Regardless of fish passage design, deauthorization may be requested due to lack of Federal interest – no navigation**

Wilmington District

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20 1775

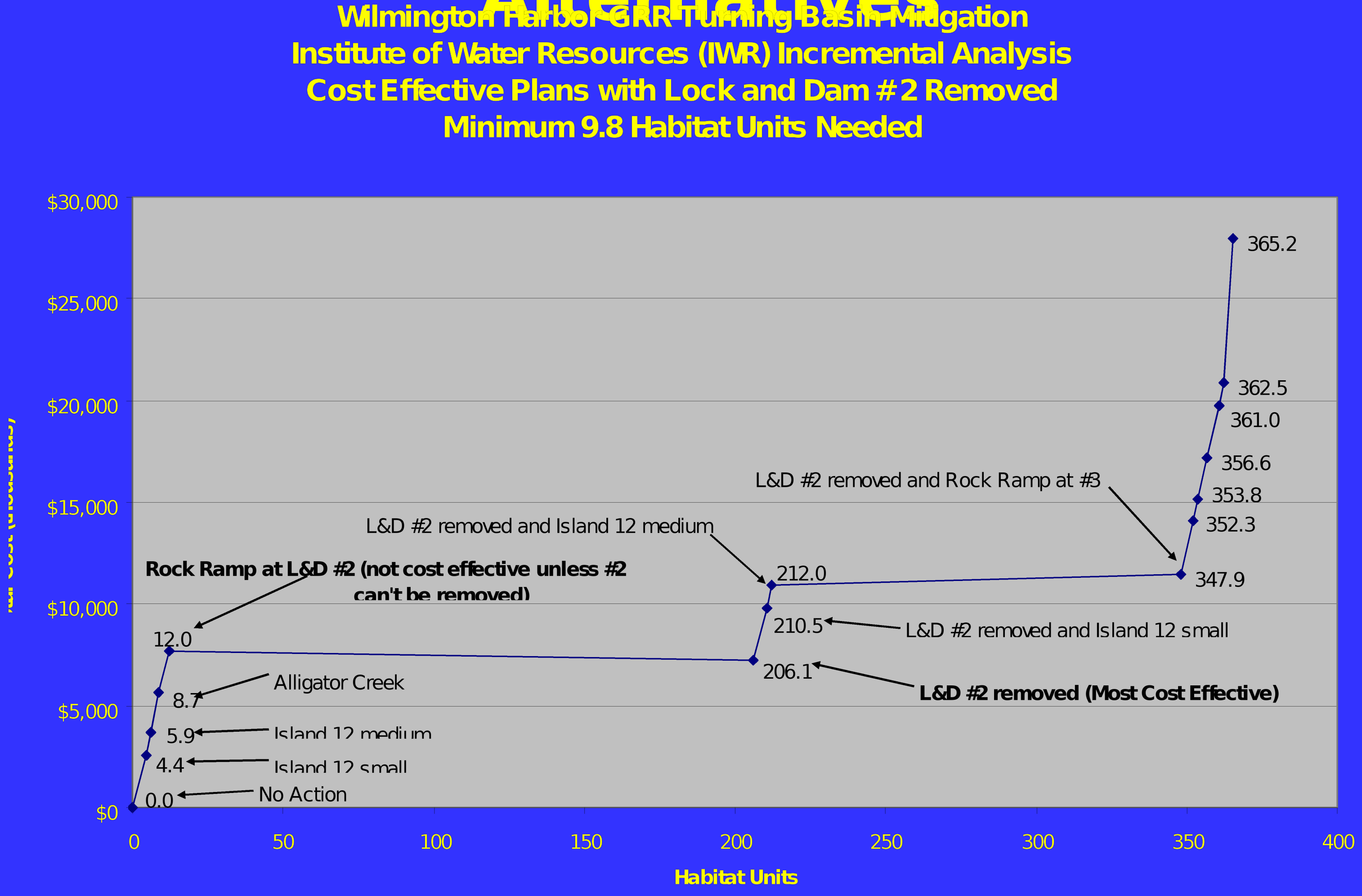
General Reevaluation Report (GRR)

Tentatively Selected Feasible Alternatives

- **Lock and Dam #1 and #3**
  - **Rock rapids downstream of the dams**
    - **No impact to existing water users**
    - **Improved fish passage**
      - Meets incremental analysis requirements
      - Fish passage factor of 8
      - Fish passage alternatives with fish passage factors < 8 don’t provide enough habitat units
    - **No impact to recreation or commercial navigation**
- **Fish passage at Lock and Dam #2 selected for mitigation for relocated turning basin**
  - **Fish passage at Lock and Dam #2 preferred over # 3 since # 2 is most downstream**
  - **Least cost alternative for required mitigation habitat units created**

Wilmington District

General Reevaluation Report (GRR) Tentatively Selected Feasible Alternatives



Wilmington Harbor GRR Turning Basin Mitigation
Institute of Water Resources (IWR) Incremental Analysis
Cost Effective Plans with Lock and Dam #2 Removed
Minimum 9.8 Habitat Units Needed

No Action
Island 12 small
Island 12 medium
Alligator Creek
Rock Ramp at L&D #2 (not cost effective unless #2 can't be removed)
L&D #2 removed (Most Cost Effective)
L&D #2 removed and Island 12 small
L&D #2 removed and Island 12 medium
L&D #2 removed and Rock Ramp at #3

$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$0
0
50
100
150
200
250
300
350
400
Habitat Units
0.0
4.4
5.9
8.7
12.0
206.1
210.5
212.0
347.9
352.3
353.8
356.6
361.0
362.5
365.2

Wilmington District

General Reevaluation Report (GRR)

Fish Passage at Lock and Dam # 2

- **Lock and Dam #2**
  - **Only dam without water supply intake upstream – intake proposed**
    - **cost impacts to proposed users being determined**
  - **40-foot deep scour hole – needs to be stabilized with or without fish passage**
  - **Elizabethtown resolution October 2, 2006 opposing removal of the locks and dams**
  - **Navy**
    - **Plan to use the site 8-10 times per year**
    - **Prefer dam left in place but can operate without**
  - **Lower pool levels**
    - **5-6 feet lower in # 3 lock chamber – fish passage should not be impacted**
    - **Still at least 5 feet of water in the river during minimum flow conditions**
  - **Decision not made yet**
    - **Either remove the dam or construct rock rapids**
      - **Rock rapids - $7.7 million (does not include cost of filling scour hole), 12 Habitat Units**

Wilmington District

General Reevaluation Report (GRR)

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20 1775

What’s Happening?

- PDT team including representatives from all concerned parties
- Extensive coordination and investigations to develop solutions
- Value Engineering Study 16-20 July 2007
- Select feasible alternatives for fish passage while assuring water supply
- Independent Technical Review 13 August – 14 September 2007

Wilmington District

General Reevaluation Report (GRR)

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20 1775

Summary of Unresolved Issues

- What authorization, if any, is required to construct rock rapids at Lock and Dams # 1&2.
- Form of Fish Passage at Lock and Dam # 2
- Impacts on potential water users if Lock and Dam # 2 is removed – rock rapids or dam removal
- Stability issues at Lock and Dam # 3 if # 2 is removed
- How can a rock rapids be funded at Lock and Dam # 3?
  - Section 1135
  - Mitigation for another project
  - Collaborative effort
- VE issues – No significant new issues
- ITR issues
  - To what extent should benefits of the authorized project be re-evaluated?
  - To what extent should the fleet be re-analyzed?
  - How should the overall and remaining project costs and benefits be incorporated into the GRR Report?
- Model certification
  - Planning – Ken Claseman and Jodi Staebell

Wilmington District

General Reevaluation Report (GRR)

Decision Matrix Lock and Dam # 2

Table 3.5.1b Decision Matrix for Fish Passage at Lock and Dam #2, Cape Fear River, NC

	Fish Passage Alternatives											
		Lower Dams		Rock Ramp								
Evaluation Factors	Remove Dams	Rock Ramp with Reduced Water Supply Capacity	No Fish Passage Needed[2]	Downstream of Dam Only	Downstream of Dam & Lock	Upstream of Dam[8]	Lock Only	Diversion Channel	Diversion Channel & Rock Ramp in Lock	Natural-like Bypass	Nature-Like Bypass & Rock Ramp in Lock	Improve Locking[1]
Pass Sturgeon & other Anadromous Fish[3] (Fish Passage Factor, 10 best passage, 1 worst)	10	8	9	8	7	8	2	3	5	3	5	
Subtotal (Weight X 2)	**20**	**16**	**18**	**16**	**14**	**16**	**4**	**6**	**10**	**6**	**10**	
Potential Effects on Water Supply Safe Yield and Associated Reliability[4] (10 least impact, 1 worst)	5	9	8	10	10	10	10	8	8	8	8	
Subtotal (Weight X 2)	**10**	**18**	**16**	**20**	**20**	**20**	**20**	**16**	**16**	**16**	**16**	
Construction and O&M Cost[5] (10 lowest, 1 highest)	8	10	10	5	4	1	10	9	8	0	0	
Commercial & Recreational Navigation Impacted (10 least impact, 1 worst)	5	5	1	10	5	5	5	10	5	10	5	
Funding potential including public and private[6] (10 best potential, 1 worst potential)	8	8	7	6	5	7	2	5	6	4	5	
Deauthorization Required	Yes	Yes	Yes	No	Yes	Yes	Yes	No	Yes	No	Yes	No
Total[7]	**51**	**57**	**52**	**57**	**48**	**49**	**41**	**46**	**45**	**36**	**36**	

1. Not feasible since the 2000 BO from NMFS required better fish passage than locking.

2. Dam lowered enough so that anadromous fish could pass over the top during spring flows, and a minimal pool would exist during drought conditions. This would preclude full use of the site by the Navy.

3. Includes increased recreational and commercial fishing benefits. If the fish passage factor is less than 8, this form of fish passage is not likely to receive concurrence from NMFS and other resource agencies. See section 3.5.2.2 for explanation of the fish passage

4. Includes loss of storage

5. The ranking of alternatiaves are inversely proportional to costs. Costs range from about $1 million (10) to $19 million (1).

6. Funding potential would be the greatest for projects that provide the maximum potential to protect water supply and greatest potential to pass anadromous fish.

7. Alternative with the highest total is the best choice.

8. The dam for the upstream alternative would have the save crest elevation as the existing dam. See section 3.5.3.5 for a description of this alternative.

Unacceptable alternative that will either not adequately pass anadromous fish, more expensive than a similar alternative, have severe an impact on water supply users, preclude the navy from passing the site, or nature-like bypass not feasible since floodplain is absent.

Wilmington District

General Reevaluation Report (GRR)

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20 1775
ESSE QUAM VIDERI

Milestone Schedule

- Alternative Formulation briefing 4 October 2007
- Draft report spring 2008
- Final report fall of 2008
- Make recommendations spring 2009. May require Congressional approval to implement

Wilmington District

General Reevaluation Report (GRR)

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA

MAY 20 1775

ESSE QUAM VIDERI

WILMINGTON HARBOR
GENERAL REEVALUATION REPORT

http://www.saw.usace.army.mil/wilmington-harbor/GRR/GR

Wilmington District

THE GREAT SEAL OF THE STATE OF NORTH CAROLINA
MAY 20 1775

Wilmington Harbor GRR

?

QUESTIONS ?

Comments